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THE HUMAN RESPONSE TO THE PHYSICAL ENVIRONMENT.¹

WE think of man as living in an environment, the elements of which are largely the subject-matter of physical geography; and we are coming to realize that the true and complete geography is a study, not of physiography and the climate merely, but of the interaction between man and the physical part of his environment.

The term "environment" is so loosely used, and is made to include so much, that we must do some careful defining, to be sure of our ground, before taking up a discussion of our subject. The general conception of environment is the *not-me* which acts and reacts upon me. But this whole universe of forces and influences outside of myself is made up in part of the material world and its forces, and in part of the spiritual world and its creations, which are quite as vital in determining my career as are many of the material considerations.

So our environment is to be analyzed in a dual way, as (1) physical, and (2) social, or sociological, as Herbert Spencer had it. Over a century ago Montesquieu, in his *Spirit of the Laws*, was fairly convinced of this analysis, and wrote so clearly and with such conviction as to the influence of the physical elements in our environment as to make himself one of the greatest contributors along this line, though he wrote before there was a science of geology, or physiography, or meteorology to furnish data or establish laws. And again about fifty years later Buckle, in his *History of Civilization*, made a wonderful statement of the significance of the purely physical elements in our social evolution, so good a presentation as to have been scarcely equaled since. And even in his time the modern science of geology was scarcely out of its swaddling-clothes, and the sciences of meteorology and geography were not yet born.

Now that the tributary fields have been well worked, observa-

¹ Read before the Central Association of Science and Mathematics Teachers, Chicago, November 27, 1903.

tions by millions made and recorded, and laws enunciated, we are able to arrive at a more complete and satisfactory analysis of our environment and make ourselves ready to recognize the effect of the fundamental physical elements.

Let me take up each of the phases of our environment and see its content and its bearing.

The *physical environment* has as its elements:

1. Climatic conditions — as hot or cold, arid or humid.
2. Land relief, or topography.
 - a) Barriers — as mountain, or desert, or water.
 - b) Character of surface — whether flat plain, or dissected plateau, or mountainous.
3. Soil — of increasing significance as time goes by.
4. Materials and forces available in a given region.
 - a) Inorganic — as metals and minerals.
 - b) Organic — plant and animal resources.
5. Competitors in the realm — whether human or by the lower animals.

The *social environment* has for its sources and influences:

1. Psychic elements.

The consciousness of kind (Giddings) giving rise to sympathy and co-operation in every stage of evolution from the lowest animal to the highest conventions of modern society.

The law of imitation (Tarde) is quite as sweeping in its application.
2. Economic relations.

The pursuit of wealth the keynote of social impulse — Karl Marx, and later exploited by Dr. Patten. Herbert Spencer works along the same lines in his interpretation of our society as a progress from militarism to industrialism.

Progress under these influences is at first unconscious — as truly cosmic as the adaptation of a plant to a new environment. And in all our social organization, even in the highest phases, the purely cosmic, or unconscious, response to the forces in the environment is effective in larger measure than most people would willingly admit. We have but to look about us, and see the measure of heedless unthought with which we have exterminated certain noble animal species, as the bison and the seal; or see the ravenous haste with which we have wasted a continent's resource of forest, and the utterly reckless way in which we are ravishing the stored sunshine of past ages in our coal resource, to see that

in very large measure we are as senseless and unconscious as the beasts of the field.

But though at first our evolution has been unconscious, and wholly the result of a chance geographic environment, sooner or later evolution becomes conscious and self-directed, and our noblest ideal for society is that it should become so in constantly larger measure. Lester F. Ward in his *Dynamic Sociology*. F. H. Giddings in his *Principles of Sociology*, and Benjamin Kidd in his *Social Evolution* all make much of this idea.

All these elements of environment express themselves in social institutions and conventions, which analyze themselves into a half-score of categories:

1. The organization of the family and the status of woman.
2. The idea of ownership in property.
3. Domestication of animals.
4. Agriculture.
5. Dress and adornment.
6. Shelter — leading to styles of architecture.
7. The use of metals.
8. The industrial arts — as in pottery, basketry, weaving, and the long list of mechanical inventions.
9. Forms of government — as military and industrial or economic.
10. Social forms and customs; beliefs, as superstitions, religions.

All these social conventions are in a large measure psychic, but all are secondary, or even tertiary. They are developed *after* they are initiated. All analyses of them come back to *initiation*. And the least analysis arrives at a purely psychological reaction — a nervous response to an external stimulus; that is, to living tissue, acting on a physical environment. And so conditions favoring or inhibiting origins in all these lines are found in the “deal” (borrowing a term from whist) of the elements in the physical environment. The game that may be played, whether aggressive and brilliant, or passive and inert, depends very largely upon the cards held. And in the distribution of the elements of the physical environment, and the emphasis laid on each, every realm and age deals out a different combination.

The origins of social institutions, just as truly as the origins of changes in the living body of the plant or animal, are found

in the conditions imposed by the physical environment, and *progress depends upon a surplus*. This thought is most significant and far-reaching, and has been excellently presented by Dr. Simon N. Patten in his latest work, *Heredity and Social Progress*. The principle of the surplus must be kept in mind at every step in an analysis of the influence of the physical environment. It is operative in the most primal phase of living tissue, and it applies at every stage in evolution up to the highest and most spiritual social institution. It will not be out of place to state briefly some of its principles:

1. A surplus of tissue in the cell gives opportunity for the occupation of more space. Hence a breaking up into multicellular structure and the differentiation of outer from inner tissue, and by an extension along this line of development, giving rise, in due time, to organs.

2. In the same way a surplus of energy in the individual man gives us the genius in one phase of development, and the liberal and iconoclast in another.

3. A surplus of energy in a social class impels to conquest, giving added power and leisure to the conqueror, making culture possible.²

I may add that a surplus of wants go hand in hand with a surplus of wealth and leisure, to make progress continuous. Contentment is a mild name for decay. A protestant is a man with a conviction, plus a good backbone, and a stiff upper lip. For such a man laws are made — to be broken. Initiative comes from such men, and progress consists often in getting out of the rut.

The physical environment, then, is important in giving the conditions for initiative, and in furnishing the opportunity for a surplus; hence making for or against progress.

The highest point of view in geography is this very study of the physical environment in its influence on man's development, as furnishing the conditions in response to which changes may or must occur, (1) in the physical organism of man, and (2) in his social organization.

But changes in man's body are almost immeasurably slow.

² See VEBLEN, *Theory of the Leisure Class*.

Notwithstanding the fact that our anthropoid ancestors began to abandon quadrupedal locomotion, it may be, over four million years ago, we are not yet wholly adapted in our bodies to an upright posture, as Brinton and others have shown. And the anatomists and physiologists enumerate 127 vestigial organs in our bodies—organs which are more or less useless now, but which functioned once, some of them dating back to an ancestor far less advanced than the *Pithecanthropus erectus* of Du Bois. We are familiar in our everyday life with many of these relics, such as the nictitating membrane of the eye and the vermiform appendix. It seems, as David Starr Jordan so wittily remarks, that the human body can never quite forget its past, but must carry around in itself perpetually the record of every stage in its physical evolution.

Our bodily response to the physical environment, then, is in many ways almost immeasurably slow. We may not yet name definitely the combinations in physical environment which give us color of skin, head form, peculiarities of hair structure, or cast of features. Yet we may definitely say what conditions stunt the stature and inhibit action. The intelligent farmer or breeder is well assured of the principles along these lines, and the giant Norman Percheron horses are the demonstration of the law of surplus in the physical environment; and just as truly the stunted pony of Shetland and the cayuse of Montana answer for the lack of surplus. Professor Ripley, in his *Racial Geography of Europe*, makes a beautiful application of these principles in the discussion of the influences of the thin soil and the hard conditions in the Auvergne. The response is found direct in the stunted, backward population, the miserable relic of a people pushed to the wall, in ages past, by more powerful tribes that came and evicted them from the rich and favored lower lands. And, again, that hard conditions dwarf stature may be shown in the study of the Jews. Downtrodden, persecuted, and narrowed in opportunities all over Europe, they have found in free and enlightened England an opportunity to take advantage of a surplus; and in the rich end of London, in the few generations they have been there, their average stature has been increased over an inch and a half.

Edwin Markham's biting poem on "The Man with the Hoe" focuses our attention on the power of hard conditions to stunt and warp both body and mind.

Now, while the rate of change in man's body is for the most part so slow that, under the merely cosmic response to the physical environment, we must look for results to the effect of hundreds or thousands of years of its influence, on the other hand, changes in man's social organization are taking place under our very eyes. And though some of the social institutions are of as slow growth as many of the changes in man's body, yet the conditions of social organization are often found vitally fixed in the *ensemble* of the elements of the physical environment of a particular region. A people moving from a given region in which a good measure of adaptation to the physical environment has been attained may find itself under the necessity of changing radically many of the social conventions to which it was accustomed, in order to survive. Of this we have record in almost numberless cases where frontiers have been passed by members of an old and static social order.

Such social adjustments, then, are relatively rapid, and there tends to be established a somewhat definite social order in a given type of geographic realm, which imposes itself upon almost any human stock which comes to occupy the region. Out of a dozen such type geographic regions which might be studied, let us choose one, and run rapidly over it, indicating briefly, as we may, the ways in which the physical environment reacts upon man, to limit, direct, and give character to his social status. In such a study of a type region the problem is to see how the elements of the physical environment determine social origins and shape their development. Let us take as a type region the arid area, and show the persistence of its influence in all the phases of social organization.

THE ARID AREA.

1. *The family and the status of woman.*—An arid plain in primitive society invites the chase. The animals of the realm are, in the first instance, of necessity herbivores. The scant grass and browse of such a plain calls for nimble deer, fleet of

foot and ranging widely. To follow such a food supply, the family of the hunter must be ready to move rapidly and on short notice. This need reduces the family to its lowest terms — father, mother, child — and makes nomads of them of necessity. This life makes man the bread-winner, and woman becomes a slave and chattel. Among the Amerind we have this shown in the Sioux, Apache, and other tribes of the great plains.

In such a region, if the animals are of such a nature as to be more useful living than dead, we come naturally to —

2. *The domestication of animals.*— With flocks and herds the food supply is less precarious, and the capacity of the region is greater. The family unit becomes larger. Sons and grandsons may stay in the family group. This provides a larger measure of social culture; but the family is still under the whip of uncertain forage and of migrations to pastures new. So social relations remain the same. We have the patriarch, and women are still inferior.

3. *Agriculture.*— With game scarce, the food supply is sought in plant life, and progress goes hand in hand with a domestication of plants. This locates the family along a river where water makes agriculture possible. In such a case women are, as a rule, the leaders, and become bread-winners equally with the men, or even superior to them. This means independence and power, and sooner or later social equality. With animals domesticated for draft, and milk as well, or meat, the food supply is made immensely more ample and more secure, and the home becomes static. The population becomes denser, and social customs, laws, and regulations become necessary. Here is the give-and-take of man to man which rubs off rough corners and brings in time refinement and culture. In America the Pueblo Indians illustrate these influences. In Egypt, Assyria, India, and China the earliest steps in civilization passed through these phases of development ages ago.

4. *The idea of ownership of property.*— On the arid plain individual property in *land* is unknown. It is so the world around. The ownership in the Russian steppe region, and many other similar regions in Asia, resides in the village, or the com-

munity. Our plains tribes have the very greatest difficulty in acquiring a notion of ownership in the land. It is as foreign to them as the ownership of air or sunshine to us. But where soil was from the start the source of bread, land is owned, and the thought is easy. It is well known that the private ownership of land is one of the foundation stones of our particular phase of civilization.

5. *Dress and personal adornment.*—The sub-arid plain and the pursuit of the deer restrict the material of dress almost wholly to skins. This is in itself a strong demand for simplicity of dress, and holds the dress ideal rather strictly to the law of utility. With the advent of a pastoral life, particularly with the possession of sheep, goats, or camels, the availability of wool invites weaving, thus adding extensively to the variety and quality of the materials for dress. This is in itself a large invitation for advance in the arts of civilization. When agriculture comes in such a region, plant fibers increase the variety and the invitation for development. If the region is cold, at least for a good part of the year, this is a condition which holds an iron hand on the character of dress, and does not permit a wide departure from the fundamental law of utility. The trousers and the close-fitting garment owe their origin to such a physical condition. If the region is hot much of the year, the *need* of clothing is by so much reduced, and the institution of dress is more largely based on the purpose of adornment. The flowing robe, the skirt, and the shawl have their origin here.

In our western civilization we have inherited from both these sources. The conservative and leisure classes retain the display garments, and the workers keep style in dress much more close to the needs of the case. The court, the church, and female society still carry the garb of leisure and of low-latitude arid lands, even into geographic environments where the retention of the style is a serious handicap and the occasion of much suffering. Here is a case of maladjustment to physical environment that flaunts itself in the face of the law of the survival of the fittest—a case where a social surplus is frittered away in useless friction with the physical environment, and energy is lost which might, if applied wisely, lift society and further civilization.

6. *Shelter—architecture.*—The need of rapid transit in following the deer reacts strongly upon the size and quality of the residence. Necessity requires a small shelter, and of light material, which can be quickly taken down and moved, and as quickly set up as need arises. The materials convenient for such purposes are poles and skins. So the tepee is a perfectly natural response to the conditions. All our tribes on the great plains had made almost a perfect adjustment along these lines when Europeans came. In the pastoral phase, woven stuff adds to variety of building materials, hence of the capacity of the abode, and so invites progress. The Tatar and Kurd have solved this problem.

When agriculture is established, the need for moving the abode does not arise. The dwelling becomes static, and so may be made of a larger variety of materials. The size is not limited nor the weight, so wood may enter more largely into construction, and as in arid lands even wood may not be plenty, sods or stones or baked clay become the building materials. So a massive construction is established because of the nature of the most convenient materials. The sun's heat is the discomfort most necessary to counteract; hence the walls grow thick. There is little rain to be shed; so the roofs become flat, and a type of architecture is evolved. The Pueblos show as a primitive phase, the Egyptians a well-differentiated style, and the Greeks a style which is perfection. But each one of them carries in every lineament the record of a climatic condition of origin. Contrast these styles of architecture of the arid lands with the Gothic, which is an evolution of the tepee adapted to a humid clime.

7. *Use of metals.*—The presence or absence of metals in a realm has a powerful bearing on the social and economic possibilities of a people. The race very probably came to the use of the metals through finding native copper. There was a copper age, which grew gradually into a bronze age; and much later, with the accumulation of wisdom in metallurgy, iron came into use. But no people could come into the use of metal without having the metals to call on. They could have developed never so wisely in all lines, but without copper or iron they would have

so serious a handicap as to make a high grade of culture out of the question. There are many coral isles in the Pacific with quite as high a culture as we could ask without the possession of the metals. Even after a high civilization is established the presence of coal and iron confers so powerful an advantage as to make their possessors great, willy nilly. Our Pueblos had the handicap of having no metals—a very serious bar against progress.

8. *Industrial arts and mechanical invention.*—Here again we are forced to see that the nature of the materials at hand shapes the possibilities in the way of progress in the long list of inventions. The origin of pottery seems closely connected with a life in arid conditions. Water is a prime necessity. It must be kept on hand. The skins of animals are convenient, but they are short-lived, and there are other obvious disadvantages. A basket lined with clay will hold water, and such a dish buried is pottery. In any case, the inventions which may be made depend upon the particular combination of the elements of the physical environment. The savage in England would make his bow of a single piece of yew. The Eskimo, lacking yew, must use his wit, and get a compound bow of bone and sinew—a work of high art.

9. *Forms of government.*—The form of government grows out of the family organization and the way in which the daily bread is won. On the arid plain the strong hunter or the powerful warrior is chief. The whole life is one of the chase and the conquest of a weaker foe. It is not a long step from the hunting of the buffalo to the hunting of an enemy in the adjoining tribe. The arid realm breeds warriors and robbers—and might is right. In a pastoral society the family is the state, in origin, and the father is the head of the government. Conditions are only slightly changed. Women are slaves and inferiors, and any evolution in government from such a foundation will end in the establishment of a hierarchy of rank, with the strongest in the highest places. It is not different in any way from the rule of the barnyard among horned cattle. It is not a question of wisdom or right, but a question of brawn. Such a basis leads to the establishment of aristocracy, which, long planted and gone to

seed, gives us the caste system in India. The culmination of all such government is the absolute monarchy, which is, in every instance, in last analysis, a military despotism.

Agriculture and the industrial arts tend to equality among workers, male and female. The tendency is to make the wise man the leader. The whole trend of such a foundation is toward democracy. Our western civilization is in constant swing between these two great tendencies, the one of which we inherit from the arid orient, the other from the agricultural lands of western Europe. And again, the Pueblos show us a primitive form of government, with the agricultural influence uppermost.

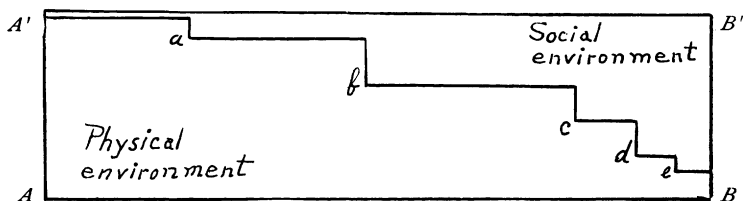
10. *Religion—social customs.*—The military organization dominates in religious establishment. In a military society the religious ideals are cast in the same mold. There is the same hierarchy, and every individual is given his station, with emphasis on obedience to the higher power. The supreme deity is the great war leader—the God of Hosts. We borrow this phase of our religion from the arid plains of the Orient. Even our hell and heaven are creations from the experiences born of a life in the hot desert and the delightful oasis.

But the practice of agriculture focuses the attention, not on a mighty conqueror, but upon the clouds. The crops depend upon the sun and the rain, and life and happiness depend upon the crops. Interest is focused on the return of the sun and the coming of the rain or the flood. This builds up a very different religion, which looks for the powers above us, in the sun and in the sky, and leads easily to the conception of the unknown god who rules the winds and brings the rains, and who lives in the sky. And these are elements found in the religion of every agricultural people settled in arid lands: Pueblo, Inca, Persian, Arabian, Hebrew.

RÉSUMÉ.

Human development, physical and social, is, at the start, unconscious, a direct response to the conditions of the physical environment—a cosmic process. But the psychic, social element enters, and the experience of the race is gradually capitalized in the form of social institutions and conventions. These become

forces competent to shape further progress, but they are clearly secondary, depending for initiation and for direction upon the conditions of the physical environment. Progress in social evolution is a record of a changing ratio between the influence of the physical environment and this growing social environment. This changing ratio shows a growing independence of the physical environment on the part of man, even a domination over it. It may be represented graphically by a parallelogram, the length of which, AB , stands for the lapse of ages occupied by human evolution, and this may be four or five million years, if we may



dare try to convert geological ages to years. The vertical ordinates AA' , BB' , represent in the terminal epochs the sum total of the forces in our environment, both physical and social, and may be most easily thought of in percentage, up to 100, at the top line. With the *Homo alalus* the social environment was at a minimum, almost zero; the physical environment essentially 100 per cent. On the invention of language (a) a sudden access of social power makes a large conquest over the physical control. With the discovery of fire (b) another conquest over nature changes the ratio, reducing the control of the physical environment. Agriculture (c), domestication of beasts of burden (d), and every useful discovery or invention, mechanical or social, have changed the ratio, giving us added dominion over the elements of our physical environment. But we can never reduce this environment to zero. Be we never so wise and ingenious, we shall always be directed, and the course of our evolution will be conditioned by its elements. These forces may be unseen, but they are nevertheless potent, and they are eternal.

J. PAUL GOODE.